

Comparison of the Clinical and Radiological Outcome of Intramedullary Nailing Versus Plating in Displaced Midclavicular Fracture: A Prospective Study

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Abstract

Background: Clavicle fractures are generally managed conservatively by 'Figure of eight bandage' or by Clavicular brace. Imminent perforation of the skin, displacement of fracture fragments, as well as non-unions are indications for operative treatment. The aim of this prospective study was to compare the clinico-radiological outcome of intramedullary-nail and plates in displaced midclavicular fracture. **Methods:** A total of 22 patients ranging 18-65 years of age were included in this study. They were randomized into two groups in simple random manner to be treated either by an intramedullary-nail or plate. Both group were compared clinically and radiologically for a minimum period of 6 months with the help of DASH score and radiograph. Intraoperative findings and complication were also noted. **Results:** There was no significant difference found between two groups with regard to clinical and radiological outcome after fracture union. DASH scores were significantly higher in plating groups at the 1st 6 weeks of follow-up. However, this difference became insignificant after 6 months of follow-up. Higher rate of blood loss, operative time, hypertrophic scar, implant loosening and implant prominence were noted in the plating group and higher rate of skin impingement were noted in nailing group. **Conclusion:** Clinico-radiological outcome remain same in intramedullary-nailing and plating group. However, intramedullary nailing is advantageous because of- easier technique, faster healing and cosmetically better scars.

Keywords: Intramedullary Nailing, Displaced Midclavicular Fracture.

INTRODUCTION

Clavicle is the bone that connects thorax to the shoulder girdle and helps in movement at shoulder girdle. Fracture of clavicle is very common due to its subcutaneous position.

These can occur due to both high or low energy trauma. It accounts for 5 - 10% of all body fractures and approximately 44% of injuries that occur at shoulder joint. 70% - 80% fractures of clavicle occur at middle 1/3rd, 12% - 15% at lateral 1/3rd and

5% - 8% medial 1/3rd of clavicle.^[1] It has a male dominance in younger age, with a male: female ratio of 2:1.^[2]

Treatment for all clavicle fractures has been non-operative in nature, consisting of a sling.^[3] It is noted in studies, that conservatively managed displaced clavicular fractures have few complications such as non-union, mal-union, cosmetic deformity in the centre of the clavicle, shoulder discomfort, shoulder dropping, & patient dissatisfaction. It can also be complicated with venous congestion of arms &neuropraxia (as the displaced fragment compresses the brachial plexus) and malalignment of fracture may lead to shortening of clavicle >1-2 cm.^[2]

Studies have indicated that surgical intervention minimizes these suboptimal outcomes.^[1] Early fixation is advantageous for management of fresh displaced mid clavicular fractures to prevent the complications like non-union and mal-union, this not only increases the accuracy of reduction and rigid fixation but also provides quick pain relief and early functional recovery.^[4] Treatment of clavicle fracture should be determined by pattern of fracture and patient requirement.^[5] Two surgical procedures are commonly used to treat displaced mid clavicular fracture, internally by plating & intramedullary nailing. Functional outcomes after both procedures have been shown to be better than conventional method of treatment, as stated in recently done prospective randomized studies.^[6]

Controversies regarding the surgical management of displaced closed mid one third clavicle fracture in adults are apparent from the volume of literature available on this topic. There is no clear data available on the superiority of one type of fixation over the other. So this study aims to provide some data based evidence to get optimal results following intra-medullary nailing vs plating procedure among the regional populations.

AIM:

Comparison of the Clinical and Radiological outcome of intra medullary nailing versus plating in displaced mid clavicular fractures.

MATERIALS AND METHODS

This prospective study was performed in Department of Orthopaedics at TeerthankarMahaveer Medical College and Research Centre, Moradabad. 22 patients of displaced mid clavicular fracture were randomised in two group in simple random manner, 11 of them treated with Intramedullary Nailing and 11 by Plating.

Inclusion criteria

Patients age between 18-65 years of both gender with displaced midshaft clavicle fracture with less than 3 week of trauma were included in study.

Exclusion criteria

Fracture involving medial & lateral third, severely comminuted fractures, undisplaced or Open fracture, associated injury of ipsilateral upper limb (Polytrauma, neurovascular

injuries etc) and pathological fracture were excluded from this study.

Pre-procedure Protocol:

All patients were taken up for elective surgery as soon as possible, after necessary routine blood, urine, radiographic investigation and pre-anesthetic check-up. Patient was positioned in the "Beach Chair" position on operating table with sand bag below and between both the scapula. Than intravenous antibiotics and General anaesthesia were given, after that part preparation was done by scrub, paint and drape.

Operative technique

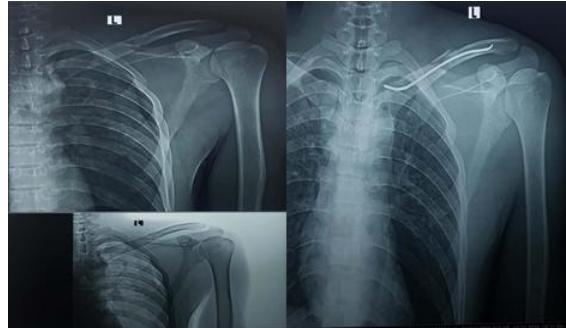
Closed Reduction and Internal Fixation with Nailing -

A skin incision was given over medial end of clavicle 2 cm in size, parallel to the clavicle. With the help of awl entry point was made over the anterior cortex, lateral to the sternoclavicular joint. A 2.5mm size titanium or screw elastic nail was inserted and advanced to the fracture site.

Fracture was reduced Subsequently in a closed manner. If reduction was not achieved by closed manner, a skin incision was make over fracture site of 2-3 cm for fracture reduction. By using small reduction forceps reduction was maintained.

With gentle rotational movements nail was subsequently advanced into the lateral fragment across the fracture site.

Open reduction was done in all fracture in which closed reduction failed.



Open reduction and internal fixation with plating:

An incision given parallel to the antero-superior margin of clavicle, and dissection was performed, then subperiosteal dissection was performed.

Fracture reduction was done and held with bone clamps.

A 3.5-mm precontoured adequate length plate was contoured to adapt to the S-shape of bone.

A 6 - 8hole plate was required in most cases when contoured it into an S-shape.

In oblique fractures a cortical lag screw was fixed across the fracture site.

A drill stopper was required when drilling the screw holes, in order to avoid neurovascular injuries.



Post-Operative Protocol

Injectable Antibiotics and analgesics were given, arm sling was given for 4

weeks in all patients after operation. Pendulum Exercise was started as soon as the pain was reduced, early physical therapy with a limited abduction upto 90° is followed for the 3 to 4 weeks after surgery. After the 3rd week of surgery patients were encouraged to resume their normal daily activities when the pain was tolerated.

Follow- UP

Patients were discharged after suture removal and were explained about the rehabilitation. They were followed up at 6th week, 3rd month and 6th month and were assessed clinically by "DASH" score Radiologically by x-ray, bridging callus formation and obliteration of the fracture lines defined the radiographic healing and absence of tenderness at the fracture site defined clinical union.^[7]

RESULTS

Table 1 Percentage and frequency distribution of participants based on results (N=22)

Results	Group 1 (CRIF with Nail)		Group 2 (ORIF with Plate)	
	n	%	n	%
Excellent	3	27.3	4	36.4
Good	6	54.5	5	45.5
Satisfactory	2	18.2	2	18.2

[Table 1] shows that majority (54.5%) of the participants had good result in CRIF with nail group, where as in ORIF with plate group majority (45.5%) of them had good result.

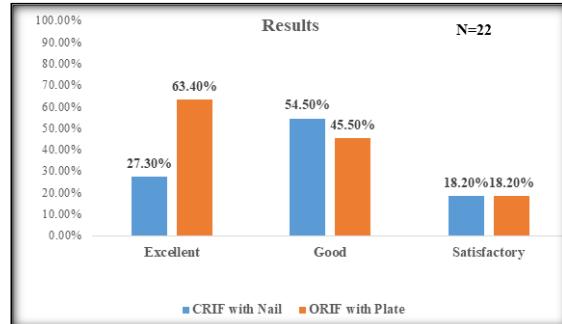


Figure 1: Bar Graph showing percentage distribution of participants based on results among CRIF with nail group and ORIF with plate group

Table 2: Comparison of "DASH" scores (Clinical outcome) among patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with Plate at different time points of observation (N=22)

"DASH " Scores (Clinica l outcom e)	Group 1 (CRIF with Nail)			Group 2 (ORIF with Plate)		
	N	M	SD	n	M	SD
6 Weeks (n=22)	1 1	33.4 0	8.9 4	1 5	27.7 5	5.2 4
3 Months (n=22)	1 1	22.9 0	4.7 7	1 1	22.4 2	5.0 3
6 Months (n=22)	1 1	14.9 0	5.9 5	1 1	15.7 5	5.3 1

[p value - 0.432(NS)]

The data in [Table 2] shows that the mean and standard deviation of 6 weeks "DASH" score of patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with Plate were 33.40 ± 8.94 and 27.75 ± 5.24 , where "DASH" score mean was higher in group 1. Whereas at 3 months and at 6 months the mean

“DASH” score of the group 1 (22.90 ± 4.77 and (14.90 ± 5.95)) and group 2 (22.42 ± 5.03 and 15.75 ± 5.31) were almost similar. The mean computed here consider the total number of sample available at each time point, i.e. 22 at 6 weeks, 22 at 3 months and 22 at 6 months.

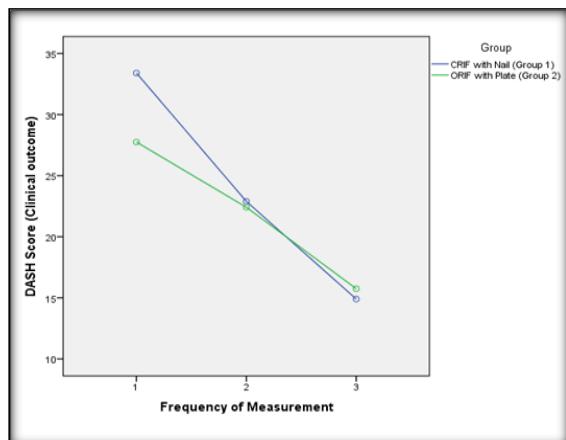


Figure 2: Mean Profile Plot showing “DASH” scores among patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with Plate

Table 3: Distribution and comparison of radiological outcome among patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with Plate at 6 months (N=22)

Radiological Outcome	Group 1 (CRIF with Nail)		Group 2 (ORIF with Plate)		Chi-square test (χ^2) & p value
	f	%	f	%	
Callus Present	0	0.0	0	0.0	NA
Union Present	1	100.	1	100.	

($p < 0.05$ significant level) NS- Non Significant

The data presented in [Table 3] shows that there is no statistically significant difference in radiological outcome among patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with plate at 6 months. All the patients in both the groups had presence of union on radiological outcome.

Table 4: Comparison of intraoperative findings among patients displaced midclavicular fracture underwent CRIF with Nail and ORIF with Plate

Intra-operative findings	Group 1 (CRIF with Nail)	Group 2 (ORIF with Plate)
Average operative time	30-60 minute	50-90 minute
Average time for healing of scar/ soft tissue	2-4 week	3-6 week

[Table 4] shows that average operative time for nailing is 30-60minutes, for plating is 50-90 minutes and average healing time for nailing is 2-4 week, for plating is 3-6 week.

[Table 5] shows that around 45.5% of the participants had impingement in CRIF with nail group, where as in ORIF with plate group around 18.2% of them had hypertrophic scar.

Table 5: Frequency and percentage distribution of participants based on complications (N=22)

Complications	Group 1 (CRIF with Nail)		Group 2 (ORIF with Plate)	
	n	%	n	%
None	6	54.5	7	63.6
Hypertrophic scar	0	0	2	18.2
Impingement	5	45.5	0	0
Implant loosening	0	0	1	9.1
Plate prominence	0	0	1	9.1

DISCUSSION

In young individuals clavicle fractures are one of the most common fractures. Management by conservative method was preferred treatment of choice previously but now surgical management has been treatment of choice to achieve early mobilization and good functional outcome, after understanding the biomechanics of fracture clavicle. Fracture patterns like comminuted, displaced and >2 cm shortening have impact on functional outcome and union.

Similar methodology was used by Pal CP et al, Fuglesang HFS et al, Narsariya N et al, Jamal E. H. Assobhi, Liu HH et al in their respective studies.^[8-12]

The present study shows a significant improvement in the "DASH" Score at subsequent follow ups. At 6th week follow up it was 33.40 ± 8.94 and 27.75 ± 5.24 in nailing and plating group respectively, at 3rd month follow up

22.90 ± 4.77 and 22.42 ± 5.03 in nailing and plating group and at 6th month follow up 14.90 ± 5.95 , 15.75 ± 5.31 respectively in nailing and plating group. This difference was insignificant. At the final follow up, 3(27.3%) cases in nailing group and 4(36.4%) cases in plating group had excellent outcome, 6(54.5%) cases in nailing group and 5(45.5%) cases in plating group had good outcome and 2(18.2%) patients in nailing group and 2 (18.2%) in plating group had satisfactory outcome.

Andrade-Silva FB et al,^[13] reported mean "DASH" score difference of 1.4 point ($p=0.329$) at 6 month follow up and mean "DASH" score was 8.5 and 9.9 in nailing and plating group respectively. At 12 month follow up mean "DASH" score difference was 1.2 point ($p=0.496$) with mean "DASH" score of 7.5 and 8.7 in nailing and plating group, Liu HH et al^[12] reported mean "DASH" score at final follow up 13.5 ± 3.9 in nailing and 12.9 ± 4.1 in plating group ($p=0.42$), Fuglesang HFS et al,^[9] reported that after 1 year follow up "DASH" score showed no statistical difference 2.0, -14.2 to 28.3 for nail versus 1.4, -4.2 to 12.1 for plate ($p = 0.5$).

In our study union was seen at 3rd month of follow up in all patients, Balachandras S et al,^[14] reported union at 3rd month follow up in 14 out of 15 (93.3%) patients who were managed by nailing and 11 out of 15 (73.3%) patients who were managed by plating, Narsariya N et al^[10] reported average bone union time for nail as 6.1

months \pm 1.8 (range 2.5-8 months) and for plate 7.4 months \pm 2.7 (range 2.5-8 months)[p=0.68], Jamal E. H. Assobhi [11] noted that average time for bone union was in the nail group is 5.2 months \pm 1.7 (range 3-9 months) and in the plate group is 7.3 months \pm 3.1 (range 3-12 months) (P = 0.034), significantly shorter in nail, Andrade-Silva FB et al,[13] reported that mean time for union in nail was 15.9 week and 16.8 week in plate, FU TH reported union at 6th month in 14(88.7%) patients in nailing and 47(94%) in plating.[15]

The present study shows hypertrophic scar in 2(18.2%) patients of plating group, skin impingement at medial end in 5(45.5%) patients of nailing group, implant loosening in 1 (9.1%) patient of plating group and plate prominence in 1(9.1%) patient. No infection, malunion, delayed union and non-union were noted in our study. Thyagarajan DS noted hypertrophic scar in 6(35.2%) patients of plating group,[16] pain in 6(35%) patients of plating group and 2(12%) patients of nailing group. Jamal E. H. Assobhi,[11] reported 3 (15.8%) patients had skin prominent and 4 (21.1%) patients with hypertrophic scars and in the plating group. In the nailing group, 3 (15.8%) patients had impingement at the medial end and 1 (5.3%) patient had asymptomatic hypertrophic callus. Eden L et al,[17] performed 1 revision surgery in plating group and in the nailing group, 1 non-union, 1 delayed union, 1 revision surgery and 2 implant removal were reported. Liu HH et al[12] noted

infection in 3(5.9%) patients of nail and 6(10.2%) patients of plate group, non-union in 5 (9.8%) patients of nail and 6(10.2%) patients of plate group and malunion in 4(7.8%) of nail and 2(3.4%) of plate group, FU TH,[15] reported infection in 1(2%) patient of plating group, non-union in 4(7.5%) patients of nail and 1(2%) patient of plate group and malunion in 2(3.8%) patients of nail and 2(4%) patients of plate group, Narsariya N et al,[10] reported infection in 1(3.03%) patient and 2(6.25%) patients in nailing and plating group respectively, implant failure in 1(3.03%) patient of nail, wound dehiscence in 3(9.37%) patients of plate, hypertrophic scar in 4(12.50%) patients of plate, re-fracture after implant removal in 3(9.37%) patients of plate, non-union in 1(3.03%) patient of nail and major revision surgeries in 1(3.03%) patient of nail and 2(6.25%) patients of plate group, Pal CP et al,[8] noted infection in 1(3.03%) patient of each nail and plate group, implant failure in 1 (3.03%) patient of nail, wound dehiscence in 2(6.06%) patients of plate, hypertrophic scar in 1 (3.03%) patient of plate, major revision surgery in 1(3.03%) patient of nail and 2(6.06%) patients of plate group, plate prominence in 3(9.09%) patients and delayed union in 1 (3.03%) patient of plate group.

Limitations

It was a comparative prospective study with short term follow up, including a small number of patients and was done at a single centre. Moreover, there are requirement of

larger randomized controlled trials to further evaluate complications and outcomes of plating and nailing in displaced mid 1/3rd clavicle fracture.

CONCLUSION

We concluded that for surgical fixation of displaced mid 1/3rd clavicular fractures both the procedures i.e nailing and plating are equally effective. However, intramedullary nailing is advantageous because it is a safe, minimally invasive surgical technique with cosmetically better scars and secure implant removal.

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